

DOCUMENT MANAGEMENT SYSTEM

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Doc# NSCS-M-P-7093-02-03
 Title: Chrome Treatment - Interim
 Issue Dt: 04/10/2002
 Revision Dt: 08/02/2018 Review Interval: 12
 Cat: Quality Doc Type: SOP
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 Desc: Environmental ISO 14001
 Loc: Midwest - Utilities-Midwest - Plant Maintenance-Midwest-Gary Works

Equipment Descriptions**Chrome Wastewater**

The Chrome Treatment Plant is used to convert dissolved hexavalent chrome in wastewater into trivalent chrome for removal as a solid before discharge. At the production units, Electrolytic Tinning Line (ETL) and Tin Free Steel (TFS), i.e. Chrome Line, the wastewater leaves the chrome treatment sections of the production units, and flows into dedicated chrome wastewater sumps. The sumps have one or more pumps which pump the hexavalent chrome wastewater to the Chrome Treatment Plant Equalization Tank.

Chrome Equalization Tank, TK-2001

The chrome wastewater is pumped to the Chrome Equalization Tank (EQ tank). This tank provides a system surge capacity that allows the influent wastewaters to "equalize" the fluctuations of the incoming hexavalent chrome concentrations. Equalization of the influent wastewaters will provide better treatment consistency. There are two identically configured treatment trains, A and B. The EQ tank serves as the wastewater source for both treatment trains. Throughout the following process description, the "A" unit is part of the treatment train A and the "B" unit is part of the treatment train B.

**Equalization Tank Transfer Pumps
P-2001A and P-2001B**

These pumps will "feed" the Trains A and B. Each pump is driven by a variable frequency drive. The flow to each treatment train is controlled by a logic based upon either maintaining a level in the Equalization Tank (Level Control) or maintaining a set flow rate (Flow Control).

**Chrome Reduction Tanks,
TK-2002 A or TK-2002 B**

The Equalization Tank Transfer Pumps feed either Chrome Reduction Tank, TK-2002 A or TK-2002 B, accordingly. In the tanks, hexavalent chrome will be converted to trivalent chrome. This is accomplished by using Sulfuric Acid to maintain the required pH range that allows Sodium Bisulfite to convert the chrome to chromium sulfate. (Chrome Reduction Tank Sulfuric Acid) Dosing Pumps, P-2009 A and B, delivers Sulfuric Acid to the Reduction Tank based upon a continuously monitoring pH probe in the tank. Sodium Bisulfite Feed Pumps, P-2005 A and B, delivers Sodium Bisulfite to the Reduction Tank based upon a continuously monitoring ORP probe in the tank.

**pH Adjustment Tanks,
TK-2003 A and B**

The wastewater from the Reduction Tank will then gravity flow to pH Adjustment Tanks, TK-2003 A and B. Caustic Feed Pumps, P-2004 A and B, deliver Sodium Hydroxide to control the tank's pH based upon a set point continuously monitored by a pH probe in the tank. This treatment step converts the chromium sulfate to chromium hydroxide. At the correct pH range

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chromium hydroxide will precipitate out of wastewater solution so it can be removed during the next treatment step.

Lamella Clarifiers, CF-2001 A and B

From the pH Adjustment Tank the wastewater will overflow to the Lamella Clarifiers, CF-2001 A and B. There are 3 separate treatment steps associated with the clarifiers. In step 1, the wastewater stream enters a "Flash Mix" tank where a coagulant is introduced using Coagulant Dosing Pumps, P-2015 A and B. In step 2, the wastewater flows from the Flash Mix tank to the "Floc" tank where a flocculant is introduced using Lamella Polymer Metering Pumps, P-2011 A and B. In step 3, the wastewater flows into the settling tank. Here the properly conditioned chromium hydroxide particles will grow into larger particles that are too heavy to remain suspended in the wastewater stream. As the wastewater rises up through the lamella inclined plates, the larger particles settle to the bottom where the Lamella Sludge Pumps, P-2002 A and B, will transfer the "sludge" to the Sludge Holding Tank, TK-2005. The clarified water will collect in the effluent trough then discharge to the Continuous Backwasher Filters F-2001 A & B.

Continuous Backwash Filters, F-2001 A and B

The wastewater will overflow from the Lamella Clarifiers and be combined with leachate from the Greenbelt II Landfill. The commingled wastewater then flows to the Continuous Backwash Filters. The clarifiers will remove most of the chromium hydroxide, although some particles that are too light and/or too small will be carried along with the wastewater to the filters. The landfill leachate also contains fine particulates. The Continuous Backwash Filters use sand as the filtering medium to capture the particles. The sand is continuously backwashed to remove the captured particles. The backwash effluent containing fine particulate is routed to the building trench and sump system, then pumped to the EQ tank to be reintroduced into the treatment system. The polished water is collected in the effluent trough then discharged from the treatment system. Samples are collected from this discharged flow, analyzed and data is presented as internal Outfall 204.

Filter Press

The sludge discharged from the Lamella Clarifiers to the Sludge Holding Tank is processed through the Filter Press. This will remove excess liquid from the sludge to create a waste cake. When the press cycle is completed the cake is dropped into a roll-off box. The cake is disposed as hazardous waste. The liquid removed from the sludge (filtrate) is returned to the EQ tank.

Building Trench and Sump

During startup or during periods when the wastewater is suspected of veering outside normal conditions, the treatment system will be placed in recycle mode. The wastewater is directed to the building trench and sump from the Continuous Backwash Filters and Lamella Clarifiers. The sump pumps return the wastewater to the Equalization Tank to re-enter the treatment system. The wastewater will remain in the closed loop until the system is within spec. The

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recycle valves will then be closed so that the treated wastewater can be discharged through Outfall 204.

Computer Control System

Is responsible for:

- Monitoring conditions in each treatment train and modulating chemical feed pumps to maintain treatment set points.
- Alert Operator that specific treatment conditions are outside set point tolerance for normal operation.
- Either recycle or shutdown a train as programmed if treatment conditions are far outside set point tolerance for normal operation.

Treatment Process**Controls****Chrome Equalization Tank, TK-2001**

Tank level is reported on the process computer screen (confirm level visually as necessary).

Minimum level 20% - to prevent cavitation of Equalization Tank Transfer Pumps

Maximum level 80% - to maintain volume for recycling and to prevent overflow

During startup determine if there is enough freeboard in the tank to allow the level to rise in the tank. When a treatment train is being started all treated wastewater will be discharged to the building trench at the Lamella Clarifiers. This startup treated wastewater will be returned to the EQ Tank. During this recycling stage there may be additional influent wastewater from the ETL and TFS lines plus contact stormwater from Greenbelt II Landfill. As necessary, shutdown these additional influent streams to prevent high tank volumes.

The pipeline to the tank from the Tin and Chrome Lines has Conductivity, ORP and pH monitoring probes that will help the operator determine if there are any abnormal conditions present in the influent wastewater stream.

Computer Control System will:

- Monitor volume level of the tank. If level is too high, an alert will be sent to the Chrome Treatment Plant Operator.
- If the level is too low, an alert will be sent to the Chrome Treatment Plant Operator and the Equalization Tank Transfer Pumps will automatically shutdown

Chrome Reduction Tanks

pH Set Point: 
 ORP Set Point: 

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Computer Control System will:

- Monitor the tank pH and ORP. Sulfuric Acid and Sodium Bisulfite chemical feed rates will automatically be modulated to maintain set points.
- Monitor pH and ORP readings of the tank. If either reading is veering out of the acceptable treatment range (low or high) an alert will be sent to the Chrome Treatment Plant Operator.
- If either the pH or ORP readings are too high an alert will be sent to the Chrome Treatment Plant Operator and the Equalization Tank Transfer Pumps will automatically shutdown.
- Maintain a minimum chemical feed rate of ████ per minute. This means that even if the set point monitoring is not calling for chemical additions, the dosing skids will continue to feed Sulfuric Acid and Sodium Bisulfite.

A key point to remember when using sodium bisulfite is when the pH goes down the ORP goes up and when the pH goes up the ORP goes down. Realize that pH controls the final outcome of the ORP. It is very important that the pH be in the proper control range when the ORP is checked for compliance to the control plan. If the pH is not in the proper range adjust the sulfuric acid flow first, obtain the proper pH control range, then recheck the ORP and adjust the chemical feed to obtain a proper ORP.

pH Adjustment Tanks

pH set point: ████

Computer Control System will:

- Monitor the tank pH. Sodium Hydroxide feed rates will automatically be adjusted to maintain set point.
- Monitor pH readings of the tank. If reading is outside of the acceptable treatment range (low or high) an alert will be sent to the Chrome Treatment Plant Operator.
- If the pH readings are far too high, an alert will be sent to the Chrome Treatment Plant Operator and the train will automatically enter into Recycle operation.

Lamella Clarifiers

During startup, the flow through the Lamella may be discharged to the building trench and returned to the EQ tank until proper treatment in each tank has been established. When proper treatment conditions have been established, the Lamella's discharge valve to the building trench may be closed. This will allow treated wastewater to overflow to the effluent channel, and continue to the Continuous Backwash Filters.

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Flash Mix Tank coagulant chemical addition:

Computer Control System will calculate the dosing pump speed based upon the flow rate, stroke volume, and target dosage of coagulant.

Floc Tank flocculant chemical addition:

Computer Control System will calculate dosing pump speed based upon the flow rate, stroke volume, and target dosage of flocculant.

Continuous Backwash Filters

Continually cleans the sand while simultaneously removing fine particulate solids and discharging treated water.

Computer Control System will:

- Monitor the filtrate to:
 - Confirm that effluent pH range is correct so that chromium hydroxide particles do not re-dissolve into the wastewater and pass through filtration
 - Confirm that effluent pH meets our NPDES discharge permit limits
- If pH readings are outside of the acceptable treatment range (low or high) an alert will be sent to the Chrome Treatment Plant Operator.
- If the pH readings are either far too high or too low an alert will be sent to the Chrome Treatment Plant Operator plus the train will automatically initiate Recycle operation.

Filter Press

The Filter Press has its own Programmable Logic Controller (PLC) with a Human Machine Interface (HMI) for operator control. The operator needs to initiate the start of the press cycle. When the press cycle is completed the operator will then open the press using the HMI and scrape the sludge cake off the filter cloth if the cake does not freely fall into the roll-off box below.

CTP Computer Control System

The control system is continuously assisting in the operation of the Chrome Treatment Plant system.

If you experience a temporary power loss, the CTP Control Computer has a backup power source. Even though there may be a power loss, the Control Computer should continue to operate. This power source will last for approximately 1 hour. Use this time to properly shutdown the treatment system.

If, for some reason, the Control Computer did shutdown completely the system will restart and automatically log on in the USER mode. (The USER mode is your normal operating condition so all controls should respond properly.)

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If you are not sure the CTP Control Computer is still properly controlling the treatment process, the system may need to be shutdown. Remember to contact ETL and TFS lines to have them shutdown. In addition, transfers from Greenbelt II Landfill sump will need to be stopped by closing the valve on the leachate influent pipeline to the sump..

As soon as possible, call the Help Desk at [REDACTED]. If they can timely return the Control Computer to proper operation you may return to operating the Chrome Treatment Plant.